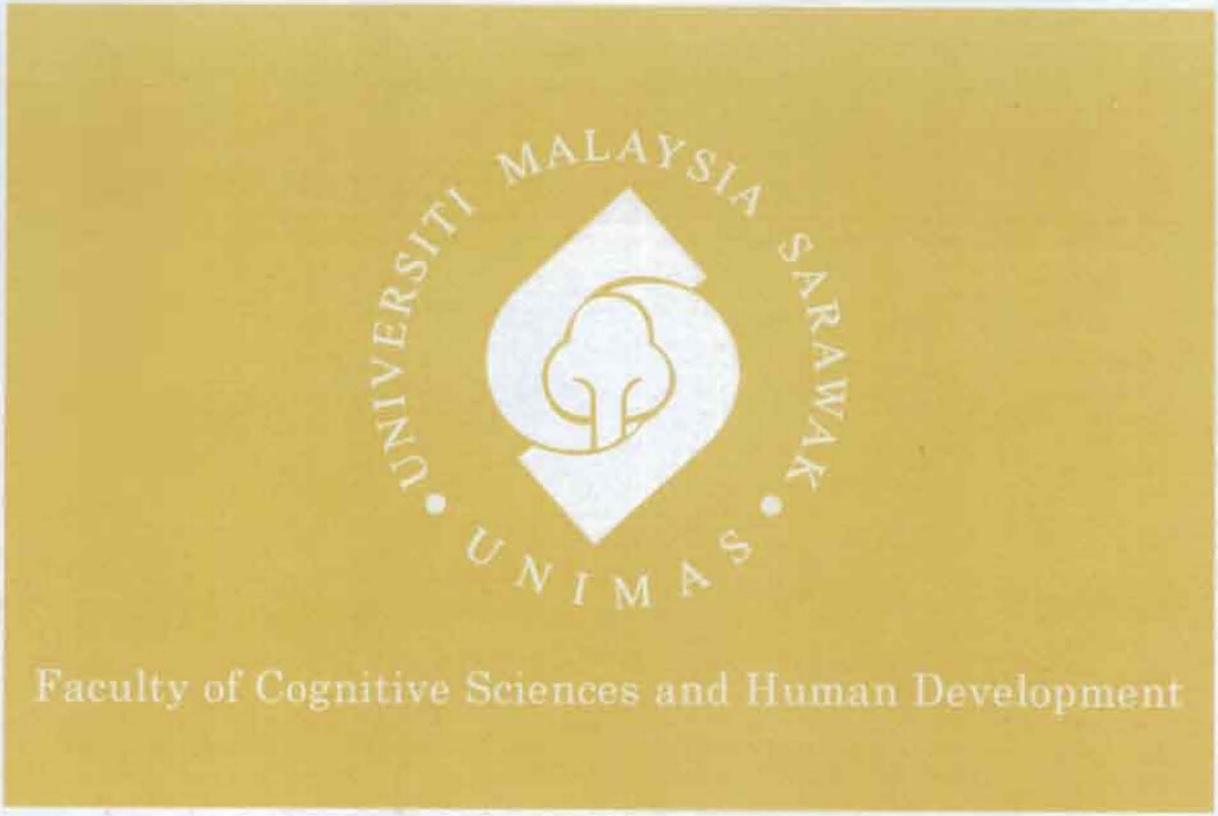

LINGUISTIC FACTORS IN MATHEMATICS TEST

Rosyaida Binti Abdul Kadir @ Ahkong

Master of Science
(Learning Sciences)
2015

FAKTOR LINGUISTIK DALAM UJIAN MATEMATIK

ROSYAIDA BINTI ABDUL KADIR @ AHKONG

Projek ini merupakan salah satu keperluan untuk
Sarjana Sains
(Sains Pembelajaran)

Fakulti Sains Kognitif dan Pembangunan Manusia
UNIVERSITI MALAYSIA SARAWAK
2015

LINGUISTIC FACTORS IN MATHEMATICS TEST

ROSYAIDA BINTI ABDUL KADIR @ AHKONG

This project is submitted in partial fulfilment of the requirements for a
Master of Science
(Learning Sciences)

Faculty of Cognitive Sciences and Human Development
UNIVERSITI MALAYSIA SARAWAK
2015

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SESI PENGAJIAN : 2014/2015

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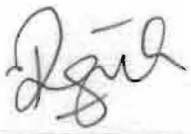

5 JUN 2015

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Statement of Originality

The work described in this KML6066 Research Paper, entitled
"Linguistic Factors in Mathematics Test"
is to the best of the author's knowledge that of the author except where due reference is made.

JUNE 5, 2015

(ROSYAIDA BINTI ABDUL KADIR @ AHKONG)
13030235

Projek bertajuk 'FAKTOR LINGUISTIK DALAM UJIAN MATEMATIK' telah disediakan oleh ROSYAIDA BINTI ABDUL KADIR @ AHKONG dan telah diserahkan kepada Fakulti Sains Kognitif dan Pembangunan Manusia sebagai memenuhi syarat untuk Sarjana Sains (Sains Pembelajaran).

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Tarikh:

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A

The project entitled 'LINGUISTIC FACTORS IN MATHEMATICS TEST' was prepared by ROSYAIDA BINTI ABDUL KADIR @ AHKONG and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfillment of the requirements for a Master of Science (Learning Sciences).

Received for examination by:

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Date:

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Masters ☒

PhD ☐

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This declaration is made on the 5th day of June 2015.

Student's Declaration:

I, **Rosyaida Binti Abdul Kadir @ Ahkong, 13030235, Faculty Of Cognitive Sciences And Human Development** hereby declare that the work **Linguistic Factors in Mathematics Test** is my original work. I have not copied from any other students' work or from any other sources except where due reference or acknowledgement is made explicitly in the text, nor has any part been written for me by another person.

JUNE 06, 2015

ROSYAIDA BINTI ABDUL KADIR
(13030235)

Supervisor's Declaration:

I, **Assoc. Prof. Dr. Hasbee Hj. Usop** hereby certifies that the work entitled **Linguistic Factors in Mathematics Test** was prepared by the above named student, and was submitted to the **Faculty of Cognitive Science and Human Development** as a * partial/full fulfillment for the conferment of **Master of Science (Learning Sciences)** and the aforementioned work, to the best of my knowledge, is the said student's work.

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First of all, I would like to thank Allah for everything. I am also very thankful for having such a lovely and wonderful family. To my parents, my husband and my children, thank you for your endless support and love. I would also like to acknowledge the enthusiastic supervision of Assoc. Prof. Dr. Hasbee Hj Usop during the completion of this work. He had been giving me advice, ideas, and guides. I am also very grateful of his kindness and tolerance. I would also like to express my gratetitude to the course coordinator, Mr Mohd Hafizan bin Hashim for his guidance and constant reminder. I would have been lost without both of you. I am also thankful to my colleagues for giving me support and feedback. Thank you very much to all of you.

TABLE OF CONTENTS

CHAPTER 4 – FINDINGS

CHAPTER 5 – DISCUSSION, RECOMMENDATIONS AND CONCLUSION

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

LINGUISTIC FACTORS IN MATHEMATICS TEST

Rosyaida binti Abdul Kadir @ Ahkong

Written test was believed to be inefficient in measuring the ability of student in mathematics. This is because in mathematics test, it contains both numerical and word problem. In mathematics word problem, it contains the linguistic factors that resulted in the complexity of the problem. The complexity of the language in the mathematics word problem could affect the performance in mathematics. Therefore, the purpose of this study is to investigate the effect of linguistic factor to the difficulty of mathematics test item. Content analysis was used to obtain the data from Form 5 Paper 1 Mathematics test that were administered in SMK Wira Penrissen in March 2015. The difficulty of the item was represented by the probability of the students answering the item correctly. The results show that out of seven linguistic factors studied, only number of symbols has a significant relationship with the difficulty of item. The difficulty of test item tends to decrease when the number of symbols increases. Further analysis was done using linear regression in order to make a prediction on the effect of linguistic factors on the difficulty of test item. The predictive equation is given by Difficulty of Test Item = 0.404 – 0.09Number of Symbols. Overall, linguistic factors seem to have little impact on the difficulty of the test item. Therefore, clear language that is free of unnecessary complexity is important in designing the items for mathematics test specifically, and in mathematics learning generally.

ABSTRAK

FAKTOR LINGUISTIK DALAM UJIAN MATEMATIK

Rosyaida binti Abdul Kadir @ Ahkong

Ujian bertulis dipercayai tidak efisien dalam mengukur kebolehan matematik pelajar. Ini adalah kerana dalam ujian matematik terdapat masalah berbentuk nombor dan masalah berbentuk ayat. Masalah matematik yang berbentuk ayat mengandungi faktor linguistik yang boleh menyebabkan bahasa menjadi lebih rumit. Kerumitan bahasa dalam masalah matematik yang berbentuk ayat boleh mempengaruhi pencapaian dalam matematik. Oleh itu, kajian ini bertujuan untuk mengkaji kesan faktor linguistik terhadap kesukaran item dalam ujian matematik. Analisis kandungan digunakan untuk memperoleh data daripada Kertas 1 ujian Matematik Tingkatan 5 yang dijalankan di SMK Wira Penrissen pada Mac 2015. Kesukaran item ditunjukkan oleh kebarangkalian pelajar menjawab soalan tersebut dengan betul. Dapatan kajian menunjukkan bahawa daripada tujuh faktor linguistik yang dikaji, hanya bilangan simbol yang mempunyai hubungan yang signifikan terhadap kesukaran item. Analisis dilanjutkan lagi dengan menggunakan regresi linear bagi membuat jangkaan untuk kesan faktor linguistik terhadap kesukaran item dalam ujian matematik. Persamaan jangkaan yang diperoleh ialah Kesukaran Item Ujian = 0.404 – 0.09Bilangan Simbol. Keseluruhannya, faktor linguistik dilihat memberi sedikit impak terhadap kesukaran item ujian. Oleh itu, bahasa yang jelas dan bebas daripada kesukaran yang tidak diperlukan penting dalam membentuk item untuk ujian matematik secara khasnya dan untuk pembelajaran matematik secara amnya.

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter introduces the research area of the paper. The chapter starts by describing the background of the study followed by stating the problems. Next, the chapter outlines the objectives of the study which includes the general and specific objectives. From the objectives, research questions and research hypothesis were developed. The chapter also includes the conceptual framework, significance of the study, limitations of the study and finally, the definition of terms.

1.1 Background of the Study

Assessment is important in learning as it evaluates student's understanding and the most common type of assessment used in learning is summative assessment. Summative assessment is given periodically to determine at a particular point in time what students know and do not know and it is usually in the form of written test. Most schools and learning institution still prefer summative assessment because it can help to evaluate the effectiveness of programs, school improvement goals, alignment of curriculum and student placement in specific programs (Garrison & Ehringhaus, 2007). However, in mathematics learning, to what extent that this written test is able to measure students ability in mathematics? This is

because the item in mathematics test could be in the form of numerical problem and word problem. For numerical problem, students can easily understand the question and concentrates on solving the problem. Therefore, if the student was able to solve the problem, then he is good in mathematics. However, in word problem, students need to read and comprehend the question before solving the problem. Therefore, the students need not only have mathematical skills but also reading comprehension skills in solving mathematics word problem. Besides that, linguistic complexity of mathematics word problem could also affect the difficulty of the item and this complexity was caused by certain linguistic factors. In general, language can affect the performance in mathematics.

1.2 Problem Statement

In the Malaysia Education Blueprint 2013 – 2025 which was introduced in 2012, assessment is one of the important dimensions in analysing the Malaysian curriculum. Students in Malaysia are usually assessed by school test and national test such as UPSR and SPM. These tests were used as an indicator in the performance of student in every subject. Moreover, in the Blueprint, the ministry of education are aiming to develop and apply the 21st century curriculum and assessment in the Malaysian education system. One way to achieve this is by upgrading the assessment framework in order to increase questions that test higher-order thinking skills.

In mathematics test, increasing the number of questions that test higher-order thinking skills also means that the number of mathematics word problem in a test will increase. The Ministry of Education (2012) stated in the Blueprint that by 2016, higher-order thinking skills' questions will make up 80% of UPSR questions, 80% of the Form 3 central

assessment, 75% of the questions for SPM core subjects and 50% of the questions for SPM elective subjects. This means that if an SPM mathematics test consists of 40 questions, then there will be 30 questions that test higher-order thinking skills. So there will be more than 30 items that is in the form of word problem. When a student was given a mathematics word problem, he will have to read and comprehend before he can solve the problem mathematically. Therefore, if the student has a low reading comprehension skill, or the word problem is too complex to be comprehend, then the student will not be able to solve the problem. Failing to solve a mathematics question often shows that the students have a mathematics ability problem. However, does the student really have a mathematics ability problem, or does the mathematics word problem is difficult to be read? Therefore, this study aims to investigate the influences of linguistic factors in mathematics test.

The research that studied the effect of language in mathematics word problems has been done by a lot of researcher and mostly, the studies investigated the impact of language on English Language Learners (ELL). There were only a few studies that investigated the impact of native language on mathematics performance. Moreover, there were several ways that these researchers used in order to relate language and mathematics performance.

Hence, this study investigates the influence of linguistic factors in a Form 5 Paper 1 Mathematics test in SMK Wira Penrisen. There are seven linguistic factors which are taken from previous researches. The linguistic factors were chosen based on the suitability since the mathematics test items were administered in Malay language (Bahasa Melayu).

1.3 Research Objectives

1.3.1 General Objective

The general objective of this study is to investigate the influences of linguistic factors in mathematics test.

1.3.2 Specific Objectives

Specifically, the study intended to achieve the following objectives:

1. To determine the relationship between linguistic factors (number of words, number of symbols, number of digits, number of sentences, compound sentences, complex sentences and prepositional phrase) and the difficulty of mathematics test item.
2. To determine the effect of linguistic factors (number of words, number of symbols, number of digits, number of sentences, compound sentences, complex sentences and prepositional phrase) on the difficulty of mathematics test item.

1.4 Research Questions

1. What is the relationship between linguistic factors (number of words, number of symbols, number of digits, number of sentences, compound sentences, complex sentences and prepositional phrase) and the difficulty of mathematics test item?
2. Do linguistic factors (number of words, number of symbols, number of digits, number of sentences, compound sentences, complex sentences and prepositional phrase) affect the difficulty of mathematics test item?

1.5 Research Hypothesis

$H_0$1: There is no relationship between number of words and the difficulty of test item.

$H_0$2: There is no relationship between number of symbols and the difficulty of test item.

$H_0$3: There is no relationship between number of digits and the difficulty of test item.

$H_0$4: There is no relationship between number of sentences and the difficulty of test item.

$H_0$5: There is no relationship between compound sentences and the difficulty of test item.

$H_0$6: There is no relationship between complex sentences and the difficulty of test item.

$H_0$7: There is no relationship between prepositional phrase and the difficulty of test item.

$H_0$8: The difficulty of mathematics test item is affected by linguistic factors.

1.6 Conceptual Framework

This study investigates the relationship of linguistic factors of word problem and the difficulty of mathematics test item and how these factors affect the difficulty of the test item. There are seven language characteristics used in this study and every word problem items were analysed based on those characteristics. The difficulty of the test item is the probability of the students getting a correct answer for the item. The conceptual framework of the study is shown in Figure 1.1 below.

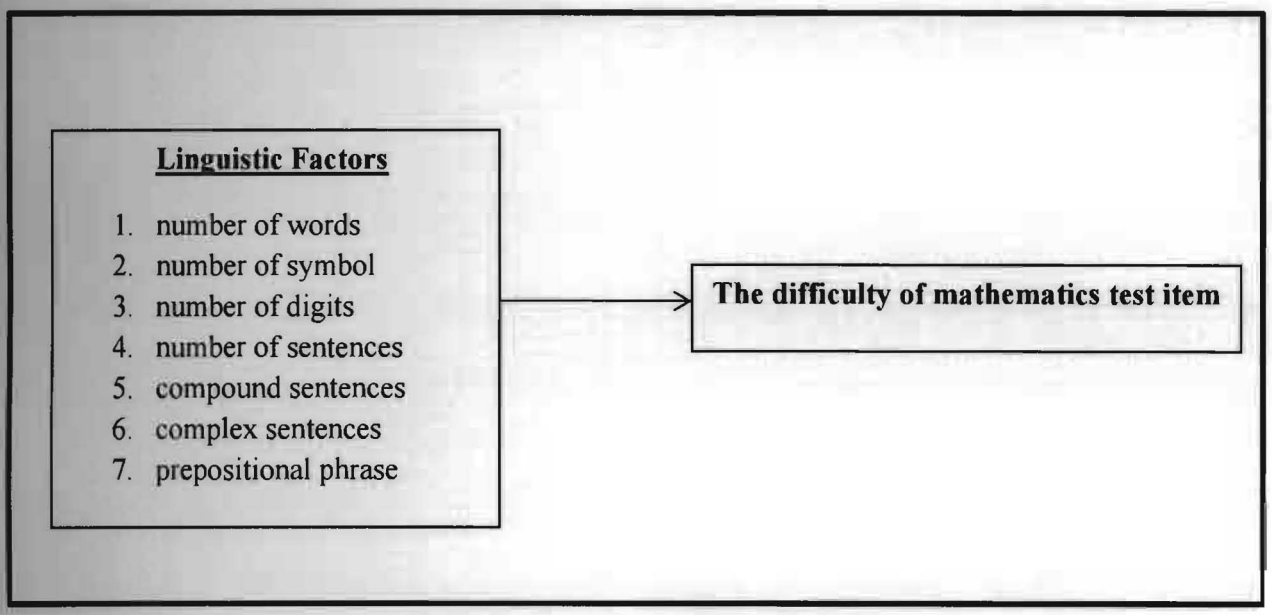

Figure 1.1: *Conceptual Framework of the Study*

1.7 Significance of the Research

The knowledge gained from this study can help to improve the development of mathematics test item so the test can be a fair tool to assess student's performance. The findings of the study are also important to create awareness on the importance of other factor such as linguistic factors in learning and in designing instructions in the form of assessment particularly.

Teachers could also change the way of teaching mathematics so the students are able to solve contextualized word problems and possess higher-order thinking skills. One way is by presenting students with a lot of real-world problems rather than teaching them to memorize the mathematics concept. By this way, students will get familiar with the real-world situation and when they were given mathematical problem in the future, the will not

spend too much effort in understanding the situation and concentrate on the mathematical problem solving.

The content analysis performed in this research could also be applied to other written test from other subject area. Therefore, quality of learning can be improved and in particular, the quality of assessment can be improved.

Finally, the findings of the study could also change the way the policy makers measure the mathematics ability of a student. The policy makers usually use standardized test in order to measure students' ability and this measure will be used as a ticket to further their study in specific programs. Therefore, the findings of the study were hoped to be able to change the use of standardized test in measuring student ability. Instead of using standardized test, policy makers could implement the formative assessment as tool measure student ability.

1.8 Limitation of the research

The study has a few limitations. The content analysis performed in this study involved a single administration of the school mathematics test for a single level of students which is the Form 5 students and from one school only. Therefore, the results of the study cannot be generalized to other level of students and other schools. Furthermore, the analysis was only done for Paper 1 Mathematics which consists of multiple choice questions. Therefore, the results of the study cannot be generalized to the whole Mathematics paper. Besides that, the linguistic factors involved in this study were very limited because of language limitation.